

reason or another, they were forced to lower elevations and encountered northerly winds, so that, unless they landed, they were in danger of being carried in a southerly direction. Others, in starting, apparently chose to drift with the northerly winds prevailing below 1,000 meters and were carried south-southwestward from Milwaukee. Mr. H. E. Honeywell, of St. Louis, Mo., an independent pilot, and Lieut. W. F. Reed, of Mobile, Ala., representing the Navy, the winners of second and third places, respectively, landed in southern Missouri, covering a distance of between 500 and 600 miles.—*E. H. Haines.*

NEW ORLEANS FORECAST DISTRICT.

Small-craft warnings were displayed on the Texas coast on the 1st, 8th, 9th, and 10th, being changed to southeast storm warnings on the 1st at 3 p. m. These warnings were justified. Thunderstorms on the east coast of Texas were attended by gales for a brief period, about 8:30 a. m. on the 15th, for which no warnings were displayed.

A disturbance of moderate intensity near the eastern and middle Gulf coasts prevailed from the 25th to the 31st. It was sufficiently intense to warrant the display of northeast storm warnings during the night of the 28th and the following day and night. Warnings were displayed accordingly on the Louisiana coast.

Warning of frost in the Texas Panhandle and extreme northwestern Oklahoma was issued on the 11th.—*R. A. Dyke.*

DENVER FORECAST DISTRICT.

An area of low pressure which began to develop over the southern Rocky Mountain Plateau on the 6th and another disturbance which appeared over British Columbia and Alberta on the same date formed, during the 7th, a trough which extended from the two Canadian Provinces already mentioned southward to northwestern Mexico. On the morning of the 10th the same storm was central over western Colorado, whence it moved slowly northeastward, reaching Manitoba during the 12th. Precipitation occurred in every portion of this district, except southern New Mexico, at some time during the period from the 7th to the 11th, with heavy snows in southwestern Colorado, northern Arizona, and southern Utah on the 9th and 10th. Freezing temperatures followed the disturbance on the 9th in southern Utah and northern Arizona, on the 10th in southwestern Colorado, and on the 11th in extreme north-central and northwestern New Mexico. Night temperatures below freezing continued in most of this area until the morning of the 13th. The passage of the storm center was also attended by gales in Colorado and New Mexico on the 10th, which continued in northeastern Colorado on the 11th. The cold weather and rain and snow were unfavorable for live stock, especially newly shorn sheep and lambs, although there appears to have been but little loss. On the morning of the 12th the temperature was decidedly below freezing in the Gunnison Valley fruit district, reaching 25° at Hotchkiss, but no serious injury to the fruit appears to have been caused by these conditions.

Showers also fell in all except the extreme southwestern portion of the district on the 14th–15th, followed on the 16th by temperatures below freezing in the western valleys of Colorado, due to an area of high pressure which extended from the north Pacific coast south-

eastward to the Panhandle of Texas on the morning of that date. The fruit, however, again escaped injury.

A number of LOWs that moved across the Rocky Mountain region during the latter half of the month were attended by occasional showers in Colorado and Utah, and generally showery conditions on the eastern slopes of Colorado and New Mexico during the last three days accompanied a moderate LOW which occupied most of the southern plateau region, with its center over Arizona.

Frost warnings were issued as follows: For eastern Colorado on the 10th, 11th, and 13th; east of the mountains in New Mexico on the 11th; north-central and northwestern New Mexico on the 13th and 21st; north and west Utah on the 1st and 8th; north Utah on the 10th, 11th, and 26th; and for all of Utah on the 12th. These warnings were generally verified either by the occurrence of frost or temperatures at which frost might be expected.

Light frosts for which no warnings were issued occurred at Grand Junction on the 2d, Modena on the 14th and 21st, and Denver on the 16th.

Freezing temperatures were forecast as follows: At the higher elevations of southern Utah on the 2d and 26th; all of Utah on the 9th; southern Utah on the 10th and 11th; the western valleys of Colorado on the 10th, 11th, 12th, 13th, and 16th; north-central and northwestern New Mexico on the 10th, 11th, and 12th; and at the higher elevations of northern Arizona on the 26th. The forecasts, as a rule, were justified, except in northern Utah on the 10th.

A warning of frost and freezing temperature if the weather cleared was also issued for the western fruit valleys of Colorado on the evening of the 8th, when the conditions were especially critical. Continued cloudy weather and the development of a secondary storm over southern Utah prevented a fall in temperature to a dangerous degree.—*J. M. Sherier.*

SAN FRANCISCO FORECAST DISTRICT.

The Aleutian center of activity was in evidence the greater portion of the month. It sent out no less than six offshoots that affected the weather in the northern portion of this district. The permanent North Pacific HIGH sent out four offshoots that had a more or less marked influence on the weather in the Pacific States.

The LOW on the 7th from Alaska united with a disturbance that streamed northward from Arizona, and it caused quite general rains in California and the North Pacific States.

On the 17th another LOW moved north from Arizona and apparently united with one from the Northwest on the 20th. Considerable rain fell during this period, and a live-stock warning was issued on the 18th for eastern Oregon, eastern Washington, Idaho, and northern Nevada. It was not so windy nor were the rains so cold as expected; therefore this warning was only partly verified.

Another trough-shaped depression formed over California and the region between the Cascades and Rocky Mountains on the 24th. The next morning it presented such features as to call for a live-stock warning in Idaho, which was issued and was fully verified.

The North Pacific HIGH about the 15th receded from off the California coast, which caused a relatively low barometer and unsettled weather to prevail for several days in California and over the ocean to the westward. This unsettled condition culminated in general rains in

California on the 18th and 19th. After these rains had ceased the North Pacific HIGH resumed more nearly its normal position off the California coast.

One small-craft and four storm warnings were issued for one or more sections, and 12 frost warnings were sent to North Pacific stations, most of which were verified.—*E. A. Beals.*

RIVERS AND FLOODS.

By H. C. FRANKENFIELD, Meteorologist.

At the close of the month of May the Mississippi River was still in flood from Natchez, Miss., to the mouth of the river, and the Yazoo and Atchafalaya Rivers also remained in flood. A summary of the lower Mississippi floods will appear in the MONTHLY WEATHER REVIEW for June, 1922.

Aside from the lower Mississippi flood there were no floods of consequence during the month except in the rivers of Texas and in the Colorado River, the latter continuing at the close of the month. The annual rise of the Columbia River was also in progress.

The Santee River has been in flood since February 3, 1922, and remained so at the end of the month. Other rivers of the Carolinas were in moderate flood at different times during the month of May. Warnings were issued when necessary, and no damage was done, as previous rains had delayed planting and live stock had been removed from the lowlands.

The flood in the lower Tombigbee River of Alabama was of similar character, and moderate floods in the interior rivers of Ohio were without special incident.

The Illinois River fell steadily, but was still generally in flood at the end of the month.

The floods in the Red and Sulphur Rivers, while not severe, caused considerable apprehension. These floods began directly after the heavy rainfalls of April 26 and 27, and flood warnings were immediately issued.

Damage amounted to about \$15,500, and property to an estimated value of \$5,000 was reported as having been saved by the flood warnings. There was, however, considerable further delay in the cultivation of crops on lowlands that remained under water from previous floods.

The floods in most of the rivers of Texas were severe, and in some instances were the highest of record. The ground had become well saturated from the heavy rains of the latter part of April, and the streams were already much above their normal stage. Consequently, the additional heavy rains of the first decade of May caused floods that were certain to prove destructive despite the frequent warnings that were issued.

The Neches River flood again covered the lowlands for a distance of about 6 miles on the left side of the river, with additional damage amounting to about \$10,800. Value of property saved through the warnings, \$1,000. The highest stage reported was 27.5 feet at Rockland, Tex., on May 5, flood stage being at 20 feet. The highest stage in the Sabine River at Logansport, La., was 31 feet

on May 1, 7 feet above the flood stage. Losses, \$105,000. Value of property saved through warnings, \$170,000.

There were two floods in the Trinity River, one continuing from April and the other beginning after the heavy rains of May 8 and 9. The crest stage reached at Liberty, Tex., was 28.6 feet, 3.6 feet above the flood stage and 0.2 foot above the previous high-water record of January 31, 1920.

Losses and damage were of the usual character and amounted to about \$308,000, and the value of property saved through the warnings, \$67,500.

The Brazos River flood was the most destructive of all, with a crest stage at Kopperl, Tex., of 48 feet, 27 feet above the flood stage and 11.5 feet above the previous high-water record of November 8, 1918. Below Kopperl stages were relatively more moderate, but the damage and losses amounted to about \$1,742,700, of which about two-thirds was in prospective crops. Estimated value of property saved through warnings, \$415,500.

The Guadalupe River was in flood during the early days of the month. Crest stages were 30.3 feet on May 5 at Gonzales, 8.3 feet above the flood stage, and 23.2 feet on May 9 at Victoria, 7.2 feet above flood stage. Warnings were issued as required, and the losses were small.

The Colorado River flood was severe and the losses amounted to about \$800,000, of which \$700,000 were in potatoes alone, 15,000 acres having been ruined. Crest stages were from 4 to 10 feet above flood stage, and several levees gave way. Bridges were damaged and railroad tracks washed out. Maj. F. D. Lockland, viewing the river from an elevation of 7,000 feet, said, "We saw the river in Wharton County 10 miles wide, a winding, silvery expanse of flood drifting to the sea, and spreading out over the prairie so as to make it impossible to follow the bed of the river." Warnings were timely and accurate.

Floods in the Colorado River of Colorado, Utah, Arizona, and California.—Temperatures were generally above normal during the first decade of the month, and the water from the melting snows caused a sharp rise in the upper Colorado River and its tributaries. Warnings were first issued on May 4 for the lower Colorado and repeated thereafter as occasion required. Warnings were also issued for the upper portion of the drainage basin, beginning with May 6. On May 12 a crevasse occurred in levee on the right bank of the river at Hauser Bend, in the Palo Verde Valley, near Ripley, Calif., and it has been reported that the crevasse finally attained a width of 1,300 feet, carrying most of the river discharge at that point, and returning to the river at the south end. The total area of the Palo Verde Valley is about 90,000 acres. Thirty thousand acres were inundated, of which 10,000 are under cultivation and include the towns of Ripley, Palo Verde, and Rannels. There was no loss of life, but the damage amounted to probably \$1,000,000. The crest of the levee was 9 feet above the water when the crevasse occurred.

There were also some floods in the San Joaquin River of California and tributaries, and press reports state that much damage was done to growing crops. Some of these floods were in progress at the end of the month, and effort will be made to secure further information.